Appendix D

SAFE OPERATING PROCEDURE FORMAT

SOP #_____
(Assigned by ES&H, if new SOP)
CENTER #_____

SAFE OPERATING PROCEDURE
FOR
(Title of Operation)
AT
(Location or Facility)

(Provide a brief synopsis, one or two paragraphs, of the activities covered by the SOP. Indicate the purpose, major equipment/facility involved, and techniques/procedures used.)

EMERGENCY SHUTDOWN PROCEDURE **C** When appropriate, provide a brief description (one or two sentences) of the procedure to follow to shut down the activity as quickly as possible; i.e., depress the lab Emergency Power Off Button, activate a specific valve on switch, etc. This procedure is intended for use by personnel who are unfamiliar with the activity.

_____ __/__/__
1) (Type Name), Principal Author Date

_____ __/__/__
12) R.J. McConnell, ES&H Office Director Date

_____ __/__/__
3) (Type Name), Center Director Date

*Signature numbers indicate sequence of review and approval. After all required signatures are obtained, retain original and submit a final copy of the SOP to the ES&H Office.

SOP #_____
___ (Assigned by ES&H, if new SOP)
CENTER #

SAFE OPERATING PROCEDURE
FOR
(Title of Operation)

(All new SOPs should be submitted for review and approval utilizing the format prescribed below. Some deviation from the prescribed format will be allowed if there is obvious rationale for doing so. This format has been developed to aid the author in addressing all of the hazards likely to be encountered in a comprehensive fashion. It also requires the documentation of information that will be useful for archival or epidemiological purposes. Therefore, it is important that authors adhere to the format as much as possible.)

I. INTRODUCTION

(Include pertinent information such as scope, purpose of activity, expected results, etc.)

A. Activity description

B. Location (of activity, equipment, test, or operation)

C. Process (duration, frequency, run time, etc.)

D. Organizations involved (Center Name and Number; include other governmental or private participants)

II. DESCRIPTION OF SAFETY & HEALTH HAZARDS AND CONTROLS

Include all hazards greater than those routinely accepted by the general public. Immediately after each hazard, list the controls that will be in effect to reduce the risk to an acceptable level. The combined effect of multiple hazards should be addressed, if any.

If the necessary controls are already described in another document (eg., another SOP, an SAR, PHA, the chemical hygiene plan specific to the area covered by this SOP, an NREL Policy or Program, a consensus standard, etc.), that document and the controls required by it should be referenced. Complete details of the controls *do not need to be repeated*, but the location of the referenced document should be provided or it should be included in this SOP as an attachment.

Sample categories of hazards and controls follow. These samples may not be all inclusive and SOP authors must evaluate their activities for additional hazards and methods of control. The control categories are listed first and are then referenced as appropriate for each of the hazard categories.

A. **Controls C** The following categories are listed in their order of preference. The hazard presented by a particular activity may require controls from more than one category.

1. Engineering Controls **C** This is the preferred control method and utilizes physical aspects of a facility and it's support systems to eliminate a hazard or isolate it from the staff. Modifications of the facility may be necessary to implement these controls. Examples include specialized exhaust ventilation, protective enclosures (eg., sound dampening, radiation shielding, blast containment, etc.), explosion rated electrical systems, temperature/humidity conditioning, spill containment, etc.

2. Use of Established Safe Work Practices **C** The second preference for control of hazards utilizes procedures that prevent the worker from creating **C** or being exposed to **C** a hazardous condition. All activities will require some level of safe work practices. The practices must be formally established and complied with, and may include procedures established in other SOPs, SARs, laboratory chemical hygiene plans, ES&H Policy or Program, etc.

3. Personal Protective Equipment (PPE) **C** This method of control should be used as a second layer of protection or only when more preferable methods are not feasible. PPE controls may include the use of various levels of sight, hearing, respiratory and/or body protective equipment (i.e., face shields, goggles, safety glasses, ear plugs, ear muffs, air-purifying respirators, supplied air respirators, hard hats, bump caps, steel-toed shoes, gloves, lab coats, insulated clothing, etc.

4. Administrative Controls **C** This is the least desirable control method and includes practices such as reducing the worker's duration of exposure to excessive contaminant levels, limiting the number of workers exposed to an activity with a high risk of catastrophic failure, etc. SOPs that rely strictly upon administrative controls are likely to be considered too high of risk for NREL to accept. These controls should not be confused with good work practices implemented for activities already having a low level of risk.

B. **Hazards C** The following categories of hazards may be presented by activities at NREL. The risk level of a particular hazard and the controls necessary will be affected by other factors, such as quantities, conditions of use, etc. Typical controls are listed for each category.

1. **Hazardous Materials C** Gases, liquids, solids, mixtures or solutions that are flammable, combustible, toxic, highly toxic, pyrophoric, corrosive, explosive/reactive, allergens/sensitizers, or carcinogens/mutagens and teratogens.

   Controls **C** Engineering controls, laboratory chemical hygiene plan, storage and handling procedures, PPE.

2. **Electrical C** Electrocution exposure, ignition sources, and heat generation from electrical/electronic equipment and building systems.

   Controls **C** Compliance with electrical codes, NREL electrical safety and lockout/tagout procedures, and interlocks.

3. **High Pressure C** Energy release exposures from compressed gas cylinders, pressure vessels, steam generators, air compressors and receivers, and associated systems.

Controls **C** Design, installation and use per consensus standards; pressure relief provisions; blast containment and shielding; periodic hydrostatic testing and inspection; and access control.

4. **Low Pressure C** Implosion exposure from vacuum systems.

   Controls **C** Same as high-pressure controls.

5. **Temperature Extremes C** Cryogenic gases, heated/cooled materials, heat generating processes, and extreme weather conditions during outdoor activities.

   Controls **C** Engineering controls, handling and use procedures, PPE, and access controls and warning.

6. **Machinery/Equipment C** moving parts, "pinch points", energy sources, falling or shifting loads, vehicle collisions.

   Controls **C** Guarding, operating procedures, operator certifications, inspection and maintenance programs, adherence to lockout/tagout procedures, PPE.

7. **Noise C** Equipment and processes generating high sound levels.

   Controls **C** Engineering controls, and PPE.

8. **Radiation Sources (Non-ionizing) C** Intense light sources, UV light sources, and solar radiation focusing/concentrating systems.

   Controls **C** Enclosures, interlocks, work procedures, and PPE.

9. **Natural Environmental Conditions C** Extreme weather, insects, snakes and other wildlife.

   Controls **C** Facility design, work procedures, and PPE.

III. DESCRIPTION OF ENVIRONMENTAL HAZARDS AND CONTROLS

This section must be included in all SOPs. If an operation has no potential environmental impacts, the SOP should state so. (If uncertain, please consult the ES&H Office prior to writing this section.) Items to be addressed include:

A. **Air and Water Emissions C** Air and water effluent streams requiring special treatment before discharge, or that exceed environmental permits already in effect for NREL facilities shall be identified by type and anticipated volume.

B. **Hazardous Waste C** Waste streams that are characterized as hazardous must be identified by type and anticipated volume. Handling and storage procedures will need to be specified.

C. **Waste Minimization C** All reasonable efforts will be made to reduce the volumes of hazardous waste and regulated air/water emissions (eg., substitution, reuse, recycling, elimination of process, volume reduction, segregation of waste streams, etc.) and specific techniques utilized will be listed in the SOP.

D. **Decommissioning C** Potential residual contamination at the conclusion of the activity or operation will be identified. Decontamination procedures to be implemented and procedures to verify that the decontamination was effective will be included.

IV. ASSEMBLY/OPERATIONAL PROCEDURES

Include who, what, where, when, and how. Indicate the safety requirements, limits, restraints, tolerances, etc. Include operational instructions or reference documents in which operational instructions can be found; for example, an instrument handbook. Critical operations and potential consequences of non-compliance shall be emphasized.

V. PERSONNEL TRAINING

Identify the type of training required for personnel performing work under this SOP. If different training is required for different tasks, say so. Be specific.

VI. EMERGENCY INFORMATION

Include first aid, evacuation, and emergency notification procedures to be employed in the case of an accident. Append other applicable specialized emergency procedures.

VII. AUTHORIZED PERSONNEL

List all persons authorized to perform operations for which this SOP is written. If personnel are only authorized to perform limited tasks under this SOP, say so. List persons responsible for ensuring that all provisions of the SOP are observed, i.e., Team Leader and Center Director. This list should include the person's names and Center numbers.

VIII. REFERENCES

Reference appropriate memoranda, DOE or NREL manuals, directives, standards, engineering drawings, specifications, source documents, equipment manuals, manufacturers' manuals, etc.

IX. APPENDICES

Append supplemental information that is too detailed or voluminous to be included in the main body of the text. Appendices should be lettered and may include the lists of required equipment, safety checks, protective clothing, safety equipment, communications equipment, etc. It may also include other documents, procedures, etc. referenced in the SOP.

X. ADDENDUM

On occasion, following the review and approval of a document, permission to deviate from the requirements of the original SOP may be necessary. Such changes**C**if minor**C**can be made by submitting an addendum to the SOP for review and approval. An addendum may be issued to authorize a specific type of test or a one-time-only test. It may be a modified list of authorized personnel, or it may authorize use of different materials or additional sites and facilities. **Addendum require the same review and approval as the original SOP**. Once approved, they shall be attached to all copies of the original SOP. Do not utilize the addendum for making changes that are intended to be permanent. If the changes are permanent, then submit an updated SOP for review and approval highlighting any changes that have been made.